

the compass; the other portion of the deflection being due to the hard iron (that is, the semicircular deviation), a number of steel bar magnets, *M*, are placed in a disk, which is turned to the requisite angle and then raised or lowered, until the needle returns to the magnetic meridian *N S*. The magnet *H*, to nullify the heeling deviation, is placed at a predetermined distance vertically below the compass-pivot.

In considerable changes of magnetic latitude the magnets have to be slightly moved to counterbalance the altered condition of the deviations, and sometimes, also, to correspond to a partial loss of power in the magnets themselves.

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## HOUSE-DRAINAGE FROM VARIOUS POINTS OF VIEW.

By JOHN S. BILLINGS, M. D.,

SURGEON, UNITED STATES ARMY.

IN the year 1596 there was published in London a pamphlet entitled "A new discourse of a stale subject; called the Metamorphosis of Ajax. Written by Misacmos," which was followed in the same year by a second pamphlet entitled "An Anatomy of the Metamorpho-sed Ajax, wherein, by a tripartite method, is plainly, openly and demonstratively declared, explained and eliquidated by Pen, Plot, and Precept, how unsavory places may be made sweet, noisome places made wholesome, filthy places made cleanly. Published for the common benefit of builders, housekeepers, and house owners, by T. C., traveller, apprentice in poetry, practiser in music," etc.

The titles of these little books were in the style of the age in which they appeared; but the contents were something new, for they contain the first description and illustrations of a water-closet which had appeared since the days of old Rome. They contain a good deal more, it is true; for the author, Sir John Harrington, made them the medium of a Rabelaisian satire upon things in general, and his own times in particular, which was of such a character that license to print was refused, and Queen Elizabeth, who was not prudish, forbade the author from appearing at court. His reasons for his device are interesting: "For when I have found, not only in mine own poor confused cottage, but even in the goodliest and stateliest palaces of this realm, notwithstanding all our provisions of vaults, of sluices, of grates, of pains of poor folks in sweeping and scouring, yet still this same whoreson saucy stink, though he were commanded on pain of death not to come within the gates yet would prease to the chambers; I began to conceive such a malice against all the race of

him that I vowed to be at deadly feud with them till I had brought some of the chiefest of them to utter confusion, and conferring some principles of philosophy I had read, and some conveyances of architecture I had seen, with some devices of others I had heard, and some practices of mine own I had paid for, I found out this way that is after described, and a marvellous easy and cheap way it is.

"Here is the same, all put together; that the workman may see if it be well. *A*, the cistern; *b*, the little washer; *c*, the waste pipe; *D*, the seat board; *e*, the pipe that comes from the cistern; *f*, the screw; *g*, the scallop shell, to cover it when it is shut down; *H*, the stool pot; *i*, the stopple; *k*, the current; *l*, the sluice; *m*, *N*, the vault into which it falls; always remember that the servant at noon and at night empty it, and leave it half a foot deep in fair water."

It seems a long stride from Sir John Harrington's pet contrivance to the complicated fittings of a water-closet in a modern city house built under existing regulations; but the evolution has, upon the whole, been through complications toward sim-

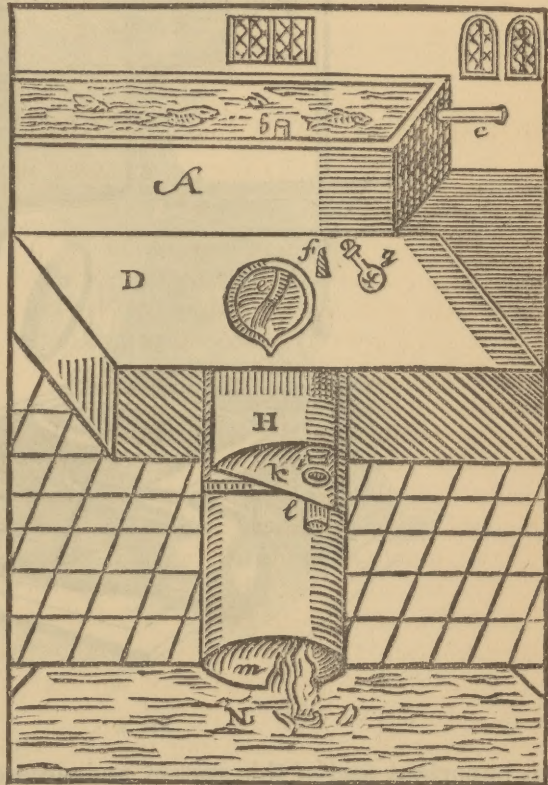


FIG. 1.

licity, as will be seen by Fig. 2, which represents a good form of closet of the present day, and the most important improvements in house-drainage have been made within the last twenty years. We can now say that, so far as the plumbing fixtures in the dwelling-house itself are concerned, freedom from nuisance and a sufficient degree of safety can be secured at a reasonable cost; provided that trustworthy workmen are employed in the construction of the work, and that the apparatus is properly managed



and cared for. Several phrases in this sentence will bear a little amplification.

In the first place, it must be clearly understood that the fixtures and pipes which form an individual system of house-drainage are only a part of the apparatus required for the disposal of offensive and dangerous refuse. Their external connections are

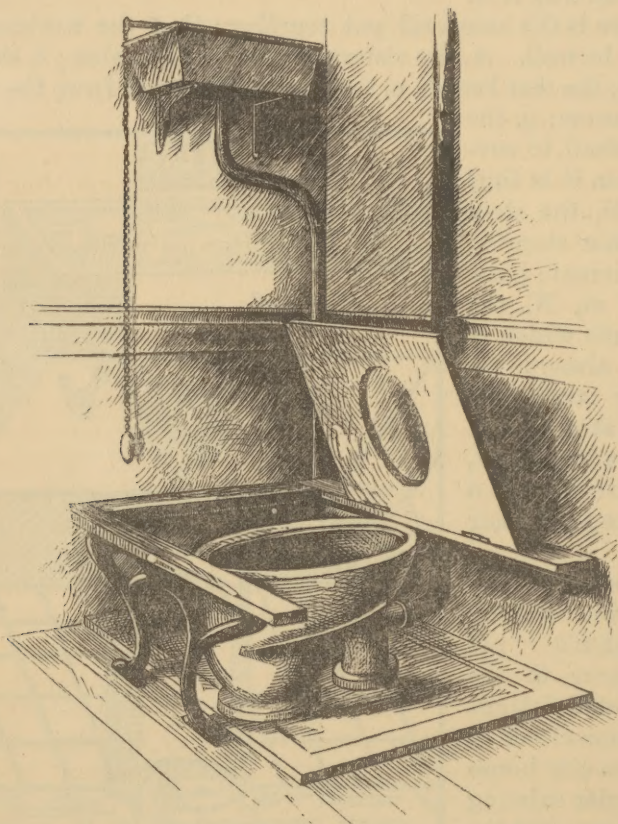


FIG. 2.

an important part of this system, and, according to whether these be with cess-pools or sewers, or whether these last are isolated or are connected with many other houses, will depend the perfection of the results obtained. In this article the house-drains and fixtures only will be considered.

Secondly, what is a "sufficient degree of safety"? Absolute safety can not be guaranteed by any system. If we can so arrange the plumbing that, so far as it is concerned, the air in the house shall be as pure and as free from specific causes of disease as the air in the streets, it is the best that can be done. Reasonable cost refers to that which is essential, and not to that which is

for ornament or luxury; it varies greatly according to the style of house, the essential point being that it shall furnish the means of getting rid of excreta and of water fouled by domestic use, without danger to the health of the inmates of the house.

What, then, are the dangers to health from defective plumbing? They are due to gases or to micro-organisms coming from defective fixtures, joints, or pipe, or from soil pollution due to such defects. The gases in question are, for the most part, products of the decomposition of organic matter of animal origin, and the types are carbonic acid, ammonia and its compounds, and sulphureted hydrogen. There are also produced certain effluvia, of the precise nature of which little is known; the most common is that giving a faint, sweetish, peculiar odor, resembling that of boiled turnips.

These gases and odors do not produce specific disease, but when they are distinctly present in a house the inmates are liable to be affected with various forms of disturbed digestion, loss of appetite, slight headache, and a depressed state of vitality. How far these are due to the gases themselves and how far to the micro-organisms present under such circumstances we do not yet know. The majority of persons gradually become so accustomed to their effects that they can live and work with little or no apparent inconvenience in an atmosphere which is so charged with them as to be not only offensive, but really dangerous to those accustomed to pure air only. Plumbers, scavengers, workers in sewers and at sewage-works, or in bone-boiling establishments, etc., prove this; but it must be remembered that these are survivors, and that a certain number who begin these occupations soon find it necessary to go into some other business. Upon the whole, the dangers from gases only in connection with house-drainage are small, and comparatively easy to avoid, the main thing for this purpose being a complete and constant ventilation of the pipes.

In part the dangers are due to extremely minute particles of living matter, most if not all of which are vegetable organisms known as bacteria. There are many different kinds of bacteria, and they have very different properties and powers, but those which concern us in this connection are those which grow and multiply in decomposing organic matters, and especially in excreta. Almost without exception these bacteria belong to species which are found in the air of streets, in all intestinal discharges, and in all putrefying matters; they are not only harmless under all ordinary circumstances, but are highly useful in decomposing dead organic matter into simple compounds available for the nutrition of plants. They are found in countless numbers in the slimy, pulpy layer of decomposing matter lining the interior



of soil-pipes, which matter they are constantly decomposing into gases and soluble products readily washed away. They are also present in large quantities in sewage as it flows in the sewers.

There are a few forms of bacteria which we have good reason to believe are the causes of certain diseases called specific. Each of these specific diseases has a definite course, and is due to the entrance into the body of particles of living matter derived, directly or indirectly, from the body of a person affected with the same disease.

We now know the particular kinds of bacteria which cause several of these diseases, and can identify them with considerable certainty. Those of most interest in connection with house-drainage are those which are supposed to cause suppuration, septicæmia, puerperal fever, erysipelas, intestinal irritation and diarrhœa, typhoid fever, and sore throats and diphtheria.

These diseases are less frequent and less fatal in sewered than in unsewered cities, and in the central sewered portion of a city than in the unsewered suburbs. Systematic house-to-house inspections in cities have shown that over one half of the houses have more or less defective and foul fixtures and leaky soil-pipe joints, so that if specific germs are often present there should be much more sickness than there is. As a matter of fact there is no evidence that scarlet fever, measles, small-pox, or whooping-cough has ever been transmitted by sewer air. There is reason to think that in a few and exceptional cases diphtheria and typhoid have been caused by inhaling sewer or soil-pipe air; but the danger of incurring these diseases in this way is small as compared with the other and usual sources of origin, although it is probable that the ordinary non-specific sore throats which sewer air tends to produce form a specially favorable site for the development of the specific microbe of diphtheria, and that in this way foul air is a predisposing cause of this disease. Schools are much more dangerous than sewers as regards the propagation of diphtheria.

The typhoid-fever bacillus is said to have been found in the air of a sewer from an institution in which there was an epidemic of typhoid, and there is a theoretical possibility that the disease might thus be produced in a house by conveyance of its germs through sewer and soil-pipe air; but such conveyance must be extremely rare. It should be distinctly understood that neither the most perfect system of house-drainage nor total absence of house-drainage will protect the inmates of the house to any considerable extent from diphtheria or from typhoid.

The most dangerous micro-organisms which are commonly found in sewer and soil-pipe air are those which produce suppuration, erysipelas, or septic poisoning when they gain access to the

interior of the body through a wound of any kind; although they may be inhaled or swallowed with comparative impunity. These are especially dangerous to new-born infants and to lying-in women, as well as to wounded persons. From my personal experience I should say that the forms of disease most frequently produced by sewer and soil-pipe air with its contained bacteria are slight inflammations of the throat, tonsillitis, and mild diarrhœal troubles.

It will be seen, therefore, that while attempts to scare people by depicting the horrors of sewer-gas, etc., in order to prevent the construction of sewers, to promote the sale of certain fixtures, or to improve the house-inspection business are not justifiable, it is certainly true that, upon ordinary insurance principles, it is wise to prevent as far as possible the entrance of sewer and soil-pipe air into dwelling-houses, offices, hospitals, and public buildings; and that a municipality is justified in taking measures to secure such prevention for those who are too ignorant, too indifferent, or too helpless to do it for themselves.

To provide, in an ordinary dwelling-house, a system of pipes and fixtures through which will quickly pass away all excreta and water rendered foul by use in closets, sinks, wash-basins, baths, etc., while the passage of gases and odors from the pipes into the house is prevented, and liability to obstruction of the pipes is as small as possible, is not now a very difficult matter under ordinary circumstances.

The differences of opinion as to the best modes of doing this, which are found in the writings of sanitarians, sanitary engineers, plumbers, etc., and which appear so confusing to one who is not familiar with the subject, are largely due to the fact that the different writers and speakers consider the matter from very different points of view; and it may be well, therefore, to refer to some of these which have the greatest influence in determining opinions.

The first point of view to be considered is that of the man who proposes to build a house for his own family, and who wants to know how he can secure, at a reasonable cost, a convenient and safe system for the removal of excreta and wastes.

If he employs an architect to prepare the plans and specifications for his house, the first suggestion would naturally be that the same architect should prepare the plans and specifications for the plumbing. It is, however, asserted by sanitary inspectors, physicians, plumbers, and popular writers, that architects do not, as a rule, furnish proper plans and specifications for house-drainage; that many of them are not competent to do it, and the rest will not take the trouble; and that to make sure of good results an expert in this particular line must be called in.



The first part of this charge, viz., that architects do not, as a rule, furnish proper plans and specifications for the plumber's work in the houses which they design, is true. They indicate upon the floor plans the positions of sinks, bath-tubs, and water-closets, and specify that the plumber's work must be done to the satisfaction of the architect, possibly stating the particular form of sink or closet that is to be furnished, especially if this has been dictated by their clients. They do not, as a rule, show the pipe-work in section or elevation. A proper set of working drawings for the plumbing of a house, upon which bids are to be made and the responsibility for plan and workmanship is to rest, and which is to be preserved as a guide for future work in changes and repairs, should be almost as minute in detail as the working drawings for the stairways or carved work. These plans and sections should show every pipe, fixture, joint, stop-cock, and trap, in their relations to walls, timbers, floors, gas and steam pipes, and ventilating flues, and give their dimensions. From these plans and specifications a competent plumber should be able, not only to make out a complete list of every length and size of pipe, trap, hanger, and fitting that he will need, but to do a considerable part of the work in his shop and deliver it ready to put in place. It must be admitted that such plans and specifications are rarely prepared, and that when they are furnished they are rarely made in the office of the architect. I do not think, however, that this fact is due so much to the inability of architects to make such drawings and specifications, as to the fact that they are unwilling to take the time and trouble to prepare them unless they are specifically demanded by their clients; thinking that any good plumber will be able to settle all the details of the work if the general scheme is only indicated, and that detailed working drawings are an unnecessary expense. Certainly the course of instruction in our schools for the systematic education of architects includes enough to enable the graduates of such schools to do this kind of work, although it may be doubted whether actual practice in the preparation of such drawings and specifications is sufficiently insisted on as compared with that required in the designing of façades and ornamental carving.

It is wise for the man who proposes to build a house to insist upon having detailed drawings and specifications for the plumbing-work, even if he does not employ an architect; the cost of obtaining them will be saved twice over in the first ten years after the building is completed, and this independent of the influence of the work on the health of the inmates. The drawings should not be folded up and put away, but should be neatly framed under glass and hung in the bath-room in a good light. The general principles to be observed in preparing such plans to obtain

the greatest freedom from nuisance, security to health, permanence of satisfactory performance, and ease and cheapness of inspection and repair, are as follows :

1. Have no more fixtures and pipes than are really necessary, and have all the fixtures as close to the soil-pipes as possible. Do not put fixed wash-basins in any sleeping-room, nor any fixture in such a position that its outlet-pipe must run horizontally, or nearly so, beneath the floor for a distance of more than ten feet before it discharges into the soil-pipe.

2. Avoid, as far as possible, the placing of fixtures in the basement or cellar of the house. In a house properly constructed from a sanitary point of view, the basement or cellar should be entirely given up to heating and ventilating arrangements and to storage, and should not contain either kitchen, laundry, sinks, or closets. All the pipes for drainage, water, gas, etc., should be plainly visible and readily accessible on the ceilings or walls of this lower story, and this can not be effected if kitchen-sinks or laundry-tubs are placed on the lowest floor. This advice can not be followed in many cases because of the expense; but it should be the rule for all houses costing twenty-five thousand dollars and upward.

3. Soil-pipes should be of cast-iron, of the kind known as extra heavy, and, for an ordinary dwelling-house, should be four inches in diameter, weighing about thirteen pounds per foot run. If the soil-pipe must be carried beneath the floor of the cellar or basement, it should be either bedded in cement or put in a brick trench with a removable cover. Every joint in a soil-pipe should be so made that it will not leak when the pipe is filled with water to a height of ten feet above the joint.

4. Provision must be made for the constant passage of a current of air through the soil-pipe from the bottom to the top, and it should have no dead ends. For this purpose it is necessary that the soil-pipe should pass up through the roof and be freely open at the top. It must not be diminished in size above the highest fixture; on the contrary, it is better that it should be slightly enlarged, so that a four-inch pipe may properly be connected with a five-inch pipe above the upper fixture. That part of the soil-pipe above the upper fixture should be of as good material and have the joints as carefully made as that below.

5. In order that a current of air shall pass through the soil-pipe, it must have an opening connected with the air below as well as above. Should this air which is to pass up through the soil-pipe be taken from the sewer, or from the air of the street? In other words, should there be a trap in the soil-pipe between the house and the sewer, with a fresh-air inlet between the trap and the house, or should the trap be omitted and the sewer be venti-



lated directly through the soil-pipes to the tops of the houses? The reply to this is, that where there are properly constructed self-cleansing sewers, having no cess-pool connections, and the house connections of which are made under the control of the engineer having charge of the sewers, it is well to omit the trap between house and sewer, and let the latter ventilate directly through the soil-pipes; but exception should be made to this where the top of a soil-pipe would be on a level with or below the windows of inhabited rooms in a neighboring house. When the house-drains are connected with a cess-pool, or with a sewer presenting the characters of a cess-pool, it is safer to insert the trap; in which case there should always be a fresh-air opening between the trap and the house. If the pipes and fixtures in a house are properly arranged, and the joints are all tight, there is very little risk to the inhabitants of the house itself in having a direct connection with an ordinary sewer without a trap; the danger really being to the inhabitants of neighboring houses. On the other hand, if the trap between the sewer and the house be properly inserted, it creates no risk of danger or nuisance in the house to which it is applied, and costs little. The argument that it checks discharges from the house and tends to produce deposit in the horizontal part of the soil-pipes next to it on the

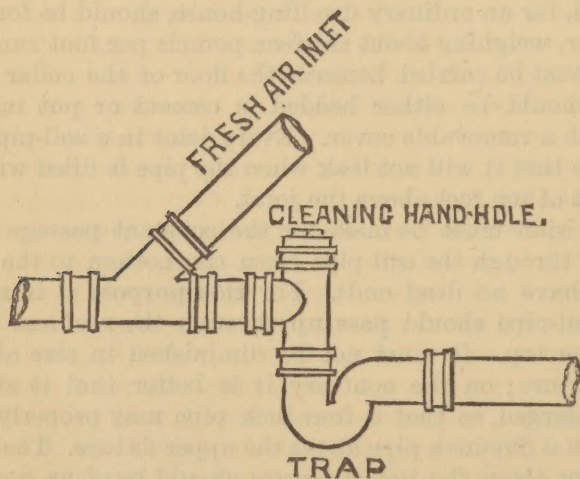


FIG. 3.

house side, is unsound if this part of the pipe has a proper fall and the top of the trap is six inches below the pipe; for I have examined pipes which had been twelve years in use under such circumstances, and found no deposit worth speaking of. A proper form of trap between house and sewer, with fresh-air inlet, is shown in Fig 3. The question is of more importance taken in connection with the ventilation of sewers by street openings as

affecting the comfort and health of the community generally than it is to the individual householder.

6. The incasing of fixtures in wood should be avoided as far as possible. The best bath-tubs and wash-basins are those in which the overflow is through a stand-pipe which is lifted to discharge the water, thus avoiding side or end overflows. The best closets are wash-out, short-hopper or siphon-jet closets. Every closet should have its own cistern, and the flushing-pipe from the cistern should be not less than one and a half inch in diameter. Housemaids' sinks should have a flushing rim and a separate cistern. Fixed laundry-tubs should never be made of wood. Urinals in a private house are usually an unnecessary nuisance; if put in, they must be cleansed frequently by rubbing. It is better that fixtures should be opposite windows than against outer walls, to avoid dark places beneath and around them, and to prevent danger of freezing the pipes.

7. To prevent the passage of soil-pipe and sewer gases, with their suspended micro-organisms, through the fixtures into the house, some form of trap must be used, and this should always be placed as close as possible to the fixture which it is to guard. The best form of trap under all ordinary circumstances is a water-trap made by a bend in the pipe, forming what are known to all plumbers as S or half-S traps. Such a trap, so long as it preserves its water-seal, affords ample protection against both gases and bacteria, and, in ordinary dwelling-houses, it is easily protected against the loss of its seal by evaporation or by siphonage. If a fixture remains unused for several months, its trap will become unsealed by evaporation. In the trap to the outlet-pipe from an ordinary wash-basin this will occur in about two months if the trap is not ventilated, and in about two weeks if it is ventilated. This will be referred to again in speaking of the care of house-drainage. As regards siphonage, the proper ventilation of the traps is a sufficient protection in all ordinary habitations of three or four stories. The ventilation of traps is not, however, solely for the prevention of siphonage; it is of equal if not greater importance to secure a current of air through all parts of the pipes so as to promote the constant oxidation and removal of the slime which lines all pipes devoted to house-drainage. The immediate agents which produce this oxidation or slow burning of the organic matter which smears the interior of the pipes are those bacteria which are called *aërobic*, because they flourish best where there is plenty of oxygen. These are Nature's scavengers; the great majority of them are not dangerous to health, but rather tend to destroy or starve out the really dangerous specific forms. They convert the soil-pipe slime into gases and soluble products, which products are washed away by the next flush of water; and



they should be given a fair chance to do their work by giving them plenty of air. Where a closet is only three or four feet from the soil-pipe, this ventilation is not necessary for keeping the pipe clear; but it is more than ever necessary to prevent siphonage. It is only under such circumstances that I would use a trap specially difficult to siphon and without ventilation; but such a trap should be cleansed every six months, for a trap which will not siphon will collect filth.

8. Whether the work be for construction or for repair, see that skilled workmen are employed upon it. There is little difficulty in finding in any large city a plumber who understands his business and takes pride in doing good work. He probably will not compete for contracts, and his prices may be from twenty to fifty per cent higher than some other plumbers will demand; but it is wisest to employ the best men, accept their advice, and not grumble about their bills. A competent sanitary engineer, by which is meant a well-educated engineer who has made a special study of water-supply, sewerage, house-drainage, etc., will make the best drawings and specifications, but first-class workmen are required to carry these out; and a class of plumbers is slowly being developed who can make plans and specifications satisfactorily, and whose advice as to fixtures, etc., can be relied upon, and such men should be sought for and employed, no matter what their prices may be.

House-drainage may also be considered from the point of view of the man who wants to know whether the plumbing actually in his house is in such condition that it is or is not worth while for him to make changes or repairs in it. It may not be such a system as he would put in if he were building a new residence; but he does not wish to incur more expense connected with it than is absolutely necessary. If no offensive odors have been perceived, and there has been no sickness in the house which would give rise to a suspicion that the drains might be out of order, he will usually be satisfied, and will not even take the trouble to carefully examine the apparatus, and still less will he be disposed to have it inspected and tested by an expert. If offensive odors are perceived in the house, and cases of disease occurring in it have roused suspicion in his mind, he will probably be more inquisitive; and, if the physician advises skilled inspection, he will usually be willing to have this made. The essential points to be determined by such an inspection are, first, whether there is leakage from any part of the soil-pipe beneath the cellar or basement; second, whether there is any obstruction to the flow of sewage to the sewer; third, whether there is any leakage of gas into the house from any joint or fixture; and, fourth, whether the soil-pipe is properly ventilated and the traps properly ar-

ranged. There are many other details which the inspector will examine; but it is not the object of this paper to describe his work. To determine the points above mentioned the inspector will wish, first, to plug the soil-pipe between the house and the sewer, so that he can fill with water that part of the pipe beneath the cellar-floor, and thus determine whether there are leakage and probable soil pollution, which will necessitate the opening of the floor to find the leak. Next, he will wish to test the vertical part of the soil-pipe, connecting-pipes, and fixtures for gas leakage, by blowing into the pipe from below either smoke or sulphurous-acid gas, or by pouring in oil of peppermint from above. Often leaky joints, damaged fixtures, etc., can be found by mere inspection; but often, also, some such special tests as those indicated above are desirable. The inspector will also wish to know precisely where all the pipes and traps of the house-drainage are, how they are connected, and what are their sizes. If the householder can show him a plan giving this information, it is well; but if not, he may have to prepare one for himself, and for this purpose to take up floors, cut into the walls, etc.

Every house-owner should have such a plan, just as he should have a record of title; and every one who hires a house will act wisely in examining such a plan before signing his lease. The proper time for obtaining this plan is when the drainage system is put in the house. This brings us to a brief consideration of a fourth point of view of house-drainage, viz., that of the sanitary authorities, or officials charged with the duty of seeing that individual premises do not become nuisances or injurious to the public health. Most of our large cities now have regulations with regard to house-drainage and sewer connection, based upon the following principles, viz.: 1. That a man must so use his property that it shall not be a source of offense or injury to others. 2. That the condition of sewers depends, to a considerable extent, on the character and condition of the sewage discharged into them, and that the municipality which is charged with the construction and maintenance of a common system of sewers has the right to regulate, within certain limits, what shall be turned into them. If cess-pool overflows, and sewage from long horizontal reaches of pipe, are turned into the sewer, it must contain putrid sewage; and it will be correspondingly difficult to ventilate it and keep it in proper condition. 3. That the arrangements for house-drainage are intimately connected with those of house water-supply; and that where the municipality furnishes a general water-supply, it has the right to make regulations and inspections to prevent waste and to see that it is properly used.

Municipal regulations for house-drainage vary somewhat in different cities; but in general they provide that, for all new



work, copies of the plans and specifications must be filed at a central office, and be approved by some competent person; that the work as it progresses, or when completed, must be inspected by a municipal officer, and that there shall be a register of those plumbers who are considered competent to do such work.

Usually also there is provision for the inspection of the plumbing of any house when there is reason to suspect that it is in a dangerous condition, or upon the application of the owner or tenant. It is common to require the ventilation of soil-pipes and traps, the trap between the sewer and the house, and the fresh-air inlet, and that all soil-pipes within the house, whether vertical or horizontal, shall be of iron. These regulations are not approved by certain manufacturers and patentees, who find that they conflict with their interests; but upon the whole it is best to allow the municipal health authorities to settle these questions, rather than to have them controlled by trade interests, and it is better to have the rules uniform, and leave as little as possible to the discretion of the officials, even though, in a few cases, this may lead to the putting in of a trap or ventilating-pipe which is not absolutely essential.

The first municipal Board of Health to carefully investigate the subject of defective house-drainage, and to issue instructions and regulations with regard to it, was the Metropolitan Board of Health of New York city under the presidency of Prof. C. F. Chandler, of Columbia College, from 1875 to 1883. To meet the requirements of the board, manufacturers rapidly produced new and improved forms of fixtures, a registration of plumbers was established by law, and the rules and regulations of New York city have practically been the model for those of other cities.

There is still another point of view to which brief reference may be made, viz., that of a man who has a pecuniary interest in certain forms of apparatus, closets, traps, etc., which he wishes to have introduced as extensively as possible. He does not approve of municipal or other regulations which make the use of his appliances difficult or expensive, and he will look favorably on those rules which require the use of his apparatus or its equivalent. It is not to be expected that he will advocate the use of new forms of apparatus, unless, indeed, he owns the patent for them, or has introduced them himself; yet this does not necessarily follow, and still less is it to be assumed that, because a man seeks to promote his pecuniary interests, his arguments and propositions are necessarily unsound, and to be condemned.

Professional men, such as physicians, architects and engineers, do not, as a rule, look favorably upon the tailoring out of patents connected with their special work. This is formulated in the code of ethics of physicians in the statement that "it is derogatory

to professional character for a physician to hold a patent for any surgical instrument or medicine." Much the same feeling exists with regard to patenting or otherwise attempting to obtain exclusive control of means for preventing disease, for supplying fresh air or pure water, for disinfection, or for the removal of the foul and dangerous substances necessarily produced by human beings in daily life; and, while the physician, the architect, or the engineer may make use of patent ventilators, filters, traps, or closets, purchasing them as manufactured articles, because they will serve the purpose, and it is easier and cheaper to buy them than to make original designs, yet they avoid giving certificates or recommendations in favor of any such patented article, and distrust those who do so. I state this as a fact, without discussing the question as to whether it is right or wrong, wise or unwise; it is given merely as one reason why in this paper I do not discuss the merits of particular forms of patented appliances for house-drainage, since it is sufficient for my purpose to show that convenience, cleanliness, and safety can be secured without the use of any particular form or piece of apparatus. At the same time it should be distinctly understood that I do not condemn all such patents or patented articles. On the contrary, I believe that the improvements which have been made in house-drainage during the last twenty-five years have been due, to a considerable extent, to the competition of business interests, urged on and directed by scientific investigations made by men who would themselves have never patented an appliance or engaged in its manufacture.

It is to be remembered that, when a system of house-drainage has been made satisfactory, it will not remain so unless it is properly used and looked after. Rust and grease will tend to obstruct the pipes, the tops of lead bends will corrode, cloths and rubbish will be thrown into the fixtures, fresh-air inlets will become plugged by snow or mud, the open top of the soil-pipe may be closed by accumulated ice. One of the most frequent dangers arising from want of care is that which results from leaving the apparatus unused for several weeks or months, as when the family shuts up the house for the summer and goes to some health resort. In a few weeks, sometimes in two weeks, the water in the traps so far evaporates that they are unsealed, and then follows a stream of air into the house, bearing with it micro-organisms which gradually settle in the layer of fine dust which gathers on floors, shelves, ledges over doors, gas-fixtures, etc. If, now, the family returns and occupies the house, using only the ordinary processes of sweeping, dusting, etc., which do not destroy the germs but merely scatter them about, there is serious danger of sickness. On leaving a house in this way, arrangements should be made to



have every fixture in it flushed at least once a week (once in three days is better), and, if it be necessary to move into a house which has been for some time unoccupied, and where you are not sure that these precautions have been observed, then thorough cleansing with cloths wetted with disinfectant solutions should be employed as a matter of ordinary prudence, and this should be applied to every exposed surface.

If the system of house-drainage is properly arranged, and the plans above referred to are at hand, its inspection is a simple matter, and should be made at least once in three years.

Finally, the art of plumbing is not to be learned from books or magazine articles. A man may be M. D., D. D., or LL. D., and be densely ignorant about house-drainage, or as to whether that of his own house is in good condition or not. Every housekeeper ought to be familiar with the pipe plans for her own house, and know just how to turn the water off from any given riser; beyond that, the truest wisdom is to be aware of one's own ignorance, and to get skilled advice whenever advice is needed.

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### TOWN-LIFE AS A CAUSE OF DEGENERACY.\*

By G. B. BARRON, M. D.

IT may be readily supposed that the conditions of life and their general surroundings must largely influence and materially affect the physical or constitutional characteristics of town-dwellers. At the onset, then, I venture to advance the proposition that the "vital force" of the town-dweller is inferior to the "vital force" of the countryman. The evidence of this is to be found in a variety of ways. The general unfitness and incapability of the dwellers in our large hives of industry to undergo continued violent exertion, or to sustain long endurance of fatigue, is a fact requiring little evidence to establish; nor can they tolerate the withdrawal of food under sustained physical effort for any prolonged period as compared with the dwellers in rural districts. It may be affirmed also that, through the various factors at work night and day upon the constitution of the poorer class of town-dwellers, various forms of disease are developed, of which pulmonary consumption is the most familiar, and which is doing its fatal work in a lavish and unerring fashion. Thus it may be conceded as an established fact that the townsman is, on the whole, constitutionally dwarfed in tone, and his life, man for man, shorter, weaker, and more uncertain than the countryman's. I hold the opinion that the deterioration is more in physique, as implied

\* Abstract of a paper read at the British Association Meeting, Bath.